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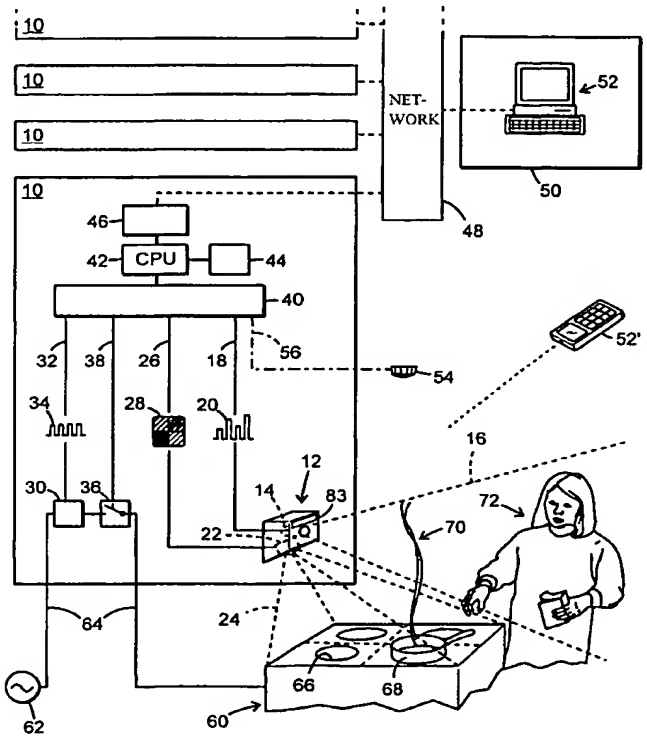


(57) Abstract: System and methods for monitoring an electric range (60). The system has a pleurality of sensing devices including a current meter (30) arranged to measure a current for heating up the electric range, a temperature sensor (22) arranged to measure a temperature of the electric range, a person detector (14) arranged to detect the presence of a person at the electric range and a smoke detector (14; 54) arranged to detect smoke generation from the electric range. A processor (42) having a timer function (44) is operatively connected to the sensor units and is arranged to calculate a heating up state of the electric range according to a program as a function of all the signals from the said detector and their durations and to determine when the heating up state changes into an overheating state calculated as a function of reference values for the said signals and their durations stored in a memory in the processor (42). A switch (36) operatively connected to the processor (42) is arranged to turn off the current for heating up the electric range (60) when the heating up state has changed into the overheating state.

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# SYSTEM AND METHOD OF MONITORING AN ELECTRIC RANGE

## TECHNICAL FIELD

The invention concerns a system and a method of monitoring an electric range.

## KNOWN TECHNOLOGY

Known so called electric range monitors according to the above usually include one, two or three sensors that detect and signal different overheating states of the electric range. Such electric range monitors can be considered static because only static signals are taken into consideration. If they are programmed for great safety with regard to overheating of the electric range and subsequent fire hazard, it becomes difficult to use the electric range for anything other than simpler warm up needs.

## SUMMARY OF THE INVENTION

An object of the present invention is to provide a more dynamic system of the type given by way of introduction that not only can take into account individual signals, but also integrate signals from all sensors and thus allow more normal use of the electric range without thereby impairing safety.

Another object is to provide a system that can handle monitoring, alarming and programming of several electric ranges centrally, for example in an assisted living building or other type of group living arrangement.

According to one aspect of the invention a system according to the invention includes a plurality of detectors including

a current meter arranged to measure a current for heating the electric range;

a temperature sensor arranged to measure a temperature of the electric range;

a person detector arranged to detect the presence of a person at the electric range;

a smoke detector arranged to detect smoke generation from the electric range; and

a processor with timer function operatively connected to said detectors and arranged to calculate a heating up state of the electric range according to a program as a function of the signals from the said detector and of the duration of these signals and to determine when the heating up state changes into an overheating state calculated as a

function of reference values for the said signals and duration saved in a memory in the processor; and

a switch operatively connected to the processor arranged to turn off the current for heating up the electric range when the heating up state changes into the overheating state.

The person detector and the smoke detector are preferably, but not necessarily, a single unit of the IR type. The received signals are analysed in order to distinguish between and classify the presence of a person and smoke particles by using the pattern of the signals.

The transmitter-receiver can also be arranged to communicate with a control or alarm system in the surroundings or with a programming unit of the IR type for readout of information from the system or input of new information to the system.

The temperature sensor that can measure the intensity of the thermal radiation from the electric range's top side is preferably an IR pyrodetector or possibly an image sensor. A compound detector composed of several sensors or an image sensor can measure the intensity of infrared radiation from different fields in the registered image of the electric range's top side and thereby measure heat generation from the electric range's different plates.

Via a network the processor can be arranged to communicate with an external computer. Thereby the system can not only report different events, such as an alarm and use patterns to a central unit or the producer, but also simply upgrade the electric range monitor with new software.

A method according to the invention to monitor an electric range using a detector and processor unit includes registration of data representing variables for time, the current for heating up the electric range, the temperature of the electric range, the presence of a person at the electric range and smoke generation from the electric range, calculation of a heating up state of the electric range as a function of the said data, comparison of the heating up state with a predetermined overheating state calculated as a function of reference values for the said variables, and turning off the current for heating up the electric range if the above mentioned heating up state corresponds to any of the predetermined overheating states.

The overheating states include the following states: continuously exceeding a threshold value for the current during a certain time interval, momentarily exceeding a threshold value for the temperature and exceeding a smoke generation value. An additional overheating state can be rising temperature after longer period of constant temperature and no person present.

Other distinctive features and advantages of the invention are made clear by the patent claims and the following detailed description of embodiments.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows schematically a system according to the invention;
Figure 2 shows a block diagram of a system according to the invention;
Figure 3 shows a simplified flow chart according to the invention; and
Figure 4 shows in diagram form examples of different states that can be detected with a system according to the invention.

## DESCRIPTION OF A PREFERRED EMBODIMENT

In the schematically presented preferred embodiment in Fig. 1, 10 denotes an electric range monitor in general arranged for monitoring an electric range 60. As further indicated in Fig. 1, the electric range monitor 10 along with other electric range monitors 10 can be included in a system that in turn via a network 48 can be administrated from an external central unit or "service provider" 50.

In the preferred embodiment each electric range monitor 10 has a plurality of detectors or sensors including a detector 14 in the form of a transmitter-receiver of the IR type, a current meter 30 and a thermal or temperature sensor 22 of the IR type, e.g. a so called IR pyrodetector. The sensors 14 and 22 are placed in a housing 12 that is intended to be attached e.g. to a wall not shown so that they have a free view of an area around the electric range 60 or its top side. Through the respective signal wires 18, 26, 32 the sensors 14, 22, 30 are connected to a processor or computing unit 42 including a microprocessor via a signal transformation unit 40 that transforms the signals 20, 28, 34 to digital form before they are fed into the processor 42. The processor 42 includes a timer 44 that is arranged to measure the duration of the different signals from the sensors 12, 22, 30. The timer is included in the processor's 42 own clock function.

Stored in a memory in the processor 42 is a program for controlling different functions of the electric range monitor 10 based on signals from the sensors 14, 22, 30. Figure 1 shows only controlling of the electric range's 60 function "ON/OFF" via a signal cable 38 using a switch 36 coupled to the cable 64 for the power supply of the electric range 60 from a current source 62. In the memory or program there are also stored reference values on the overheating state in the form of individual signals from individual sensors, but foremost temporally combined signals from several sensors that are compared with corresponding prevailing combined signal values in order to turn off the current to the electric range 60 with a switch 36 if the prevailing state corresponds to an overheating state, i.e. if there is a risk of overheating. Via a signal link not shown the program is also arranged to

control an alarm function 82 (Fig. 2) and to maintain communication with the central unit 50, which will be described in more detail in the following.

Via a transmitter/receiver 46 of the HF type or any type of cable connection, e.g. a modem and the network 48, the processor 42 is in a two-way communication with a computer 52 in the central unit 50. Events that are registered by the processor 42 of the electric range monitor 10 can be forwarded to a greater or lesser extent to the computer 52 and stored in it. Data for stored events is handled in the computer 52 in order to provide information about the electric range's 60 current use pattern. This information is used in turn to adjust the program of the electric range monitor 10 to this use pattern. For instance an electric range that needed to be shut off by the electric range monitor 10 at least once can need a program modified for a higher risk level than an electric range that despite daily use has never been near intervention by the electric range monitor 10. The computer 52 is also used to download programs into the electric range monitor 10 both for new installation and for general updating and to register a newly installed electric range monitor.

The block diagram according to Fig. 2 displays more components of the electric range monitor 10 for a commercial embodiment of the system according to the invention. In this embodiment the electric range monitor is divided into two physically separated parts, a visible part 12A and a hidden part 12B. The visible part 12A corresponds to the above mentioned housing 12 and the hidden part 12B corresponds to the current meter 30 together with the switch 36. The hidden part 12B naturally does not need to be placed near the electric range, but can be arranged in an electric distribution box (not shown) that supplies the electric range 60 with power. As is further indicated in Fig. 2 the hidden part 12B preferably has its own microprocessor 42A. When the hidden part 12B is placed near the electric range 60 for economic reasons a construction can be used in which the processor 42B also includes the processor 42A, i.e. in such a case only one processor is used.

In the preferred embodiment the current meter 30 in the hidden portion 12B is divided into two functional units 30A and 30B. The unit 30A measures current consumption when the electric range is "OFF", i.e. when no heating function is "ON" and via the processor 42 can determine if the electric range is set "ON". When the electric range is "ON" the unit 30B measures current consumption to determine if the plates 66 and possibly the oven (not shown) is being "turned up" or "turned down". For electric ranges with more than one phase the units 30A and 30B can measure each phase separately with the possibility of distinguishing between electricity consumption among the different plates and the possible oven if how the phases are coupled to the electric range is known.

The time that the electric range has been in operation is measured with the processor 42, in particular the microprocessor's 42B built-in clock function. The time is an

essential parameter for forgetful and demented people's limited use of the electric range 10 and is used along with signals from other sensors 14, 22, 30 in order to calculate the risk of overheating the electric range 10.

In addition to the earlier mentioned sensors 14, 22 the visible portion 12A of the electric range monitor 10 preferably also has a contact sensor 80. The contact sensor 80, which is preferably arranged on the case 12 (not shown), is intended to temporarily raise the electric range's 10 risk level for cooking that requires more heat possibly during a longer time. The contact sensor 10 can suitably have some type of "key function" so that it can be turned "ON" only by a qualified person. The function can consist of a physical key switch or a keypad for input of a code for adjustment of the contact sensor 10 (not shown). If the contact sensor 80 is left in mode "ON" in the electric range monitor's 10 program there is an instruction that changes the mode to "OFF" when the other sensors say that the current food preparation is finished or when a certain number of hours has passed since turning the range "ON".

In the visible part there is also a signal unit 82 for emitting an alarm with light and sound when there is a risk of overheating. The alarm is suitably given as a warning at a calculated risk lower than the risk at which the electric range turns "OFF" with switch 36. The signal unit can also include a display 83 on the case 12 to point out the risk source in clear writing or with symbols, i.e. any of the plates 66 or the possible oven.

As mentioned above the heat sensor 22 is a sensor of the IR type. According to the invention the image 28 (Fig. 1) that is registered by the sensor 22 is divided into four fields as shown, but the division can naturally also be into two or several fields depending on the number of plates on the electric range 60. The intensity of the infrared radiation that is registered by the sensors 22 in each field is a function of the heat in the field given off by the corresponding plate 66. In the program of the electric range monitor 10 there are instructions/program codes for measuring with each sensor part or with an image sensor to evaluate each field in the image 28 and calculate the heat generation from there with the processor 42. This type of image analysis is known per se and easy for a professional in the field and therefore does not require more detailed description.

As has also been mentioned the detector 14 is a transmitter-receiver of the IR type, i.e. an active sensor that sends infrared light 16 with an IR transmitter and with an IR receiver receives the light that is reflected in an area above and in front of the electric range 60. In the electric range monitor's program there are instructions/program codes that can analyse the pattern of the reflected signals. From the nature of the reflected signals 20 (Fig. 1) with the help of the processor 42 the program can detect smoke generation and persons in the area above and in front of the electric range. The soot particles in the smoke generation give a characteristic signal pattern that can relatively simply be differentiated from the also

characteristic signal pattern that is given by a human being standing in front of the electric range. This sensor function of the electric range monitor is thus programmed especially in order to detect the presence of only smoke generation and a person and ignore the presence of other things, e.g. flying insects and flickering curtains. When a person has been detected the presence can be further classified by the amplitude in association with the frequency of the reflected signals, i.e. the person's presence at the electric range is calculated or determined. A person near the electric range covers a bigger part of the sensor's 14 view and gives a different signal pattern than a person further away from the electric range, so that the electric range monitor 10 calculates a lower risk of overheating first when the person can be judged to be able to monitor it himself because of the short distances to the electric range. In a similar way strong smoke generation with many dense soot particles gives a signal pattern that differs from the signal pattern of weak fume development.

Although in the preferred embodiment the sensor 14 is a single active sensor of the IR type within the scope of the invention it is also possible to use other types of person and smoke sensors, which also can be arranged separately. According to a variant of the invention the detection of smoke development can alternatively or furthermore be provided by a conventional fire alarm 54 (Fig. 1) coupled into the system with a signal cable 56.

As indicated in Fig. 1 the active IR sensor unit 14 can also be arranged to communicate via modulated IR light with a computer in the form of a hand computer 52'. That is, the sensor unit 14 can receive data from and send data to the hand computer 52 and further communicate it to the processor 42, e.g. via either of the signal cables 18, 26.

The electric range monitor 10 in a system according to the invention can integrate the measured values of all the sensors and thereby has more complete information about the situation around an electric range than electric range monitors according to known engineering.

An example of this is shown in the diagram in Fig. 4. Curve 94 shows a time interval with rising temperature after a longer period with constant temperature simultaneously with constant current implied by curve 95 and no one present at the electric range 60. This situation indicates dry cooking and thus a danger. This state is signalled by the sensors 30, 22 and 14 to the processor 42 that from the signals combined over the time calculates an overheating state, compares this with a saved overheating state, calculates the risk of overheating and turns off the electric range. In an embodiment of the invention the risk of overheating can be classified by letting the processor 42 calculate a gradient for the rising temperature. For instance the stored overheating state can be defined in an interval A of the temperature gradient.

If, as shown by curve 96 in Fig. 5, the temperature rises more steeply, in a gradient interval B, after the longer period of constant temperature simultaneously with the constant

current, this situation indicates that a cooking vessel has been taken away from a plate 66. The curve's continuing course indicates that the presence of a person was detected and that the cooking vessel was put back for which reason it was not necessary to turn off the current to the electric range immediately. If the plate 66 had been shut off by the user within a short time there was no danger. However, unless the cooking vessel had been replaced and the user had not turned off the plate within a given time, there was a danger, and the electric range monitor would have turned off the plate. If smoke had been detected in that situation the electric range monitor would have turned off the plate immediately.

Figure 4 also shows an example of a couple of stored overheating states 90, 92 that are detected by individual sensors. The electric range always turns off if the temperature sensor 22 signals a temperature that momentarily exceeds a predetermined highest allowed temperature or threshold TT. Furthermore the electric range always turns off if a plate 66 is turned on at a power WT during a long time t1 that is determined as a function of this lower power in the program.

Figure 3 shows a principle flow chart of different functions in a system according to the invention. The flow diagram is simplified and can be configured in other ways within the scope of the invention. For instance communication with the external central unit 50 is not required for the electric range monitor's 10 function, but rather the electric range monitor can also be used by itself. However, in this case it can still be provided with interfaces for data communication so that it can be programmed on location with e.g. a hand terminal (not shown). Neither is the previously described key function 80 shown in the flow diagram.

The primary installed program in the electric range monitor 10 preferably has a so called "learning mode" whereby in the hidden part there is a switch (for example a DIP switch) with which a choice between different programs for different types of electric ranges can be made, such as electric ranges with ceramic plates, electric ranges with separate plates, etc. Further more or less restrictive limits for user type can be chosen in advance, for instance one such that only a five minute use time is allowed when no person is present.

In addition to what has already been stated about the program, the electric range monitor 10 can be considered to register the user's day-to-day use pattern and therefrom it is determined when there is a danger of overheating of the electric range 60. The separate measured values' exceeding of a "normal" level is summed to a combined "dangerous" level. The electric range monitor accepts fewer excesses of "normal" for one measurement value at a time, but turns off the electric range if several measurement values simultaneously exceed "normal" level.

The system according to the flow diagram can work in the following ways:

When installing and connecting the electric range monitor 10 the processor 42 requests the program that controls the electric range monitor, that is if the electric range

monitor 10 is configured. If the electric range monitor 10 is not configured this is called up by the signal sensor 82, e.g. in clear text on the display 83. If the electric range monitor has been connected for communication with the computer 52 of the external central 50, or possibly a hand computer or computer 52', the program is downloaded in the electric range monitor's 10 data handling unit/processor 42. Thereafter the current meter's 30 unit 30A begins to sense continuously if the electric range 60 consumes heating up power, i.e. if the electric range is "ON". If the electric range is "ON" all other sensors 44, 30B, 22, 14 begin to function and thus measure values of duration or time t, current consumption (or power) W, plate temperature T, person distance P and smoke generation S. Thereafter the program calculates the risk of overheating D as a function of these values, i.e. D = f(t, W, T, P, S).

Such a calculated risk analysis has earlier been based for instance on the time t, the current consumption W and possibly the temperature T, whereby the safety margin often needed to be large to avoid all the situations that can lead to overheating of the electric range and subsequent fire hazard. A high current consumption could then not be allowed more than at the most something like about ten minutes before the electric range monitor turned off the electric range, especially if the electric range was connected to only one phase so that only the total electricity consumption was measured. With the improved integrated system according to the invention consideration is also paid to the degree of presence of a person and smoke generation and also the temperature of each separate plate. With a person near the electric range 60 as mentioned above a detected heat emission from one or several different plates is allowed to rise quickly to a higher level than otherwise. As also mentioned above, the improved temperature sensing with the sensor 22 can indicate indirectly whether there is a heat absorbing vessel 68 on the plate when current consumption is high since the sensed temperature then does not rise as when no vessel is on the plate.

If the calculated risk of overheating is equal to or greater than a predetermined alarm risk D0 an alarm is activated by the signal sensor 82. Otherwise the measurements and the calculations continue. If the risk of overheating is greater than or equal to a predetermined fire hazard DI the electric range is turned off by switch 36. Otherwise the measurements and the calculations continue after the alarm.

If a person 72 is present near the electric range the program generally calculates a lower risk of overheating than when the electric range is unattended. And if smoke 70 is generated from the electric range 60, that is, from burnt food, the program calculates a

higher risk of overheating. In fact the program then calculates the risk as danger of fire and activates the alarm and immediately turns off the electric range 60.

It should be added that the flow diagram shown in Fig. 3 only displays how a system according to the invention can work in principle. In practice the system preferably works with so called multi-tasking, which means that the information from several sensors is handled in parallel or simultaneously in the processor 42.

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CLAIMS

1. A system for monitoring an electrical electric range (60), characterised by a pleurality of detectors including

a current meter (30) arranged to measure current for heating up the electric range;

a temperature sensor (22) arranged to measure a temperature of the electric range;

a person detector (14) arranged to detect the presence of a person at the electric range;

a smoke detector (14; 54) arranged to detect smoke generation from the electric range; and

a processor (42) having a timer function (44) operatively connected to said detectors and arranged to calculate a heating up state (D) of the electric range according to a program as a function of signals from all the detectors and their durations and to determine when the heating up state (D) changes into an overheating state (D 1) calculated as a function of reference values for the said signals and their durations stored in a memory in the processor (42); and

a switch (36) operatively connected to the processor (42) arranged to turn off the current for heating up the electric range (60) when the heating up state has changed into the overheating state.

2. The system according to claim 1, characterised in that the person detector and smoke detector include a common transmitter-receiver (14) of the IR type.

3. The system according to claim 2, characterised in that the signals received by the transmitter-receiver (14) are arranged by the processor (42) to distinguish and classify the presence of a person and smoke development using instructions for signal analysis in the program.

4. The system according to either of claims 2 and 3 characterised in that the transmitter-receiver (14) and the temperature sensor (22) are arranged in a common housing with free visibility in an area around the electric range (60) and/or its top side.

5. The system according to any of the previous claims, characterised in tha t

the temperature sensor (22) is of the IR type and arranged separately from each and every one of the electric range's (60)

6. The system according to claim 1, characterised in that the said smoke detector includes a fire alarm (54) .

7. The system according to any of the previous claims, characterised in that the processor (42) is arranged to communicate with an external computer (52) via a network.

8. The system according to any of the previous claims, characterised in that the processor (42) is arranged to communicate with an external computer (52') via a wireless connection.

9. The system according to claim 7, characterised in that the processor (42) is arranged to communicate with the external computer (52') via an IR link.

10. The system according to either of claims 8 and 9, characterised in that the person detector and/or the smoke detector is a transmitter-receiver (14) of the IR type and includes the said IR link.

11. A method of monitoring an electrical electric range with detection and processor units, characterised by

registration of data representing variables for

time (t);

current (W) for heating up the electric range;

temperature (T) of the electric range;

presence of a person (P) at the electric range;

smoke generation (S) from the electric range;

calculation of a heating up state (D) of the electric range as a function of the said data;

comparison of the heating up state with predetermined overheating states (DI) calculated as functions of reference values for the said variables;

turning off the current (W) for heating up the electric range if the said heating up state (D) corresponds to any of the predetermined overheating states (DI).

12. The method according to claim 10, characterised by the overheating states including:

continuously exceeding a threshold value (WT) for the current during a certain time interval (t0);

momentarily exceeding a threshold value (TT) for the temperature and;

exceeding a smoke generation value (S).

13. The method according to claims 10 or 11, c h a r
overheating state additionally including:

within a predetermined gradient interval (A) rising temperature after a longer period of constant temperature and constant temperature without the presence of a person.

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CLAIMS

1. A system for monitoring an electric range (60), characterised by a plurality of detectors including

a current meter (30) arranged to measure current for heating up the electric range;

a temperature sensor (22) arranged to measure a temperature of the electric range;

a person detector (14) arranged to detect the presence of a person at the electric range;

a smoke detector (14) arranged to detect smoke generation from the electric range; and

a processor (42) having a timer function (44) operatively connected to said detectors and arranged to calculate a heating up state (D) of the electric range according to a program as a function of signals from all the detectors and their durations and to determine when the heating up state (D) changes into an overheating state (D 1) calculated as a function of reference values for the said signals and their durations stored in a memory in the processor (42); and

a switch (36) operatively connected to the processor (42) arranged to turn off the current for heating up the electric range (60) when the heating up state has changed into the overheating state;

the person detector and the smoke detector comprising a common transmitter-receiver (14) of the IR type.

2. The system according to claim 1, characterised in that the signals received by the transmitter-receiver (14) are arranged by the processor (42) to distinguish and classify the presence of a person and smoke development using instructions for signal analysis in the program.

3. The system according to any of claims 1 and 2, characterised in that the transmitter-receiver (14) and the temperature sensor (22) are arranged in a common housing with free visibility in an area around the electric range (60) and/or its top side.

4. The system according to any of the previous claims, characterised in that the temperature sensor (22) is of the IR type and arranged to measure heat generation separately from each and every one of the electric range's (60) plates.

5. The system according to any of the previous claims, c h a r a c t e r i s e d in that the processor (42) is arranged to communicate with an external computer (52) via a network.

6. The system according to any of the previous claims, c h a r a c t e r i s e d in that the processor (42) is arranged to communicate with an external computer (52') via a wireless connection.

7. The system according to claim 5, c h a r a c t e r i s e d in that the processor (42) is arranged to communicate with the external computer (52') via an IR link.

8. The system according to claim 7, c h a r a c t e r i s e d in that the person detector and the smoke detector (14) includes said IR link.

9. A method of monitoring an electrical electric range with detection and processor units, c h a r a c t e r i s e d by

registration of data representing variables for

time (t);

current (W) for heating up the electric range;

temperature (T) of the electric range;

presence of a person (P) at the electric range and smoke generation (S) from the electric range by a transmitter-receiver of the IR type;

calculation of a heating up state (D) of the electric range as a function of the said data;

comparison of the heating up state with predetermined overheating states (DI) calculated as functions of reference values for the said variables;

turning off the current (W) for heating up the electric range if the said heating up state (D) corresponds to any of the predetermined overheating states (DI).

10. The method according to claim 9, c h a r a c t e r i s e d by the overheating states including:

continuously exceeding a threshold value (WT) for the current during a certain time interval (t0);

momentarily exceeding a threshold value (TT) for the temperature and;

exceeding a smoke generation value (S).

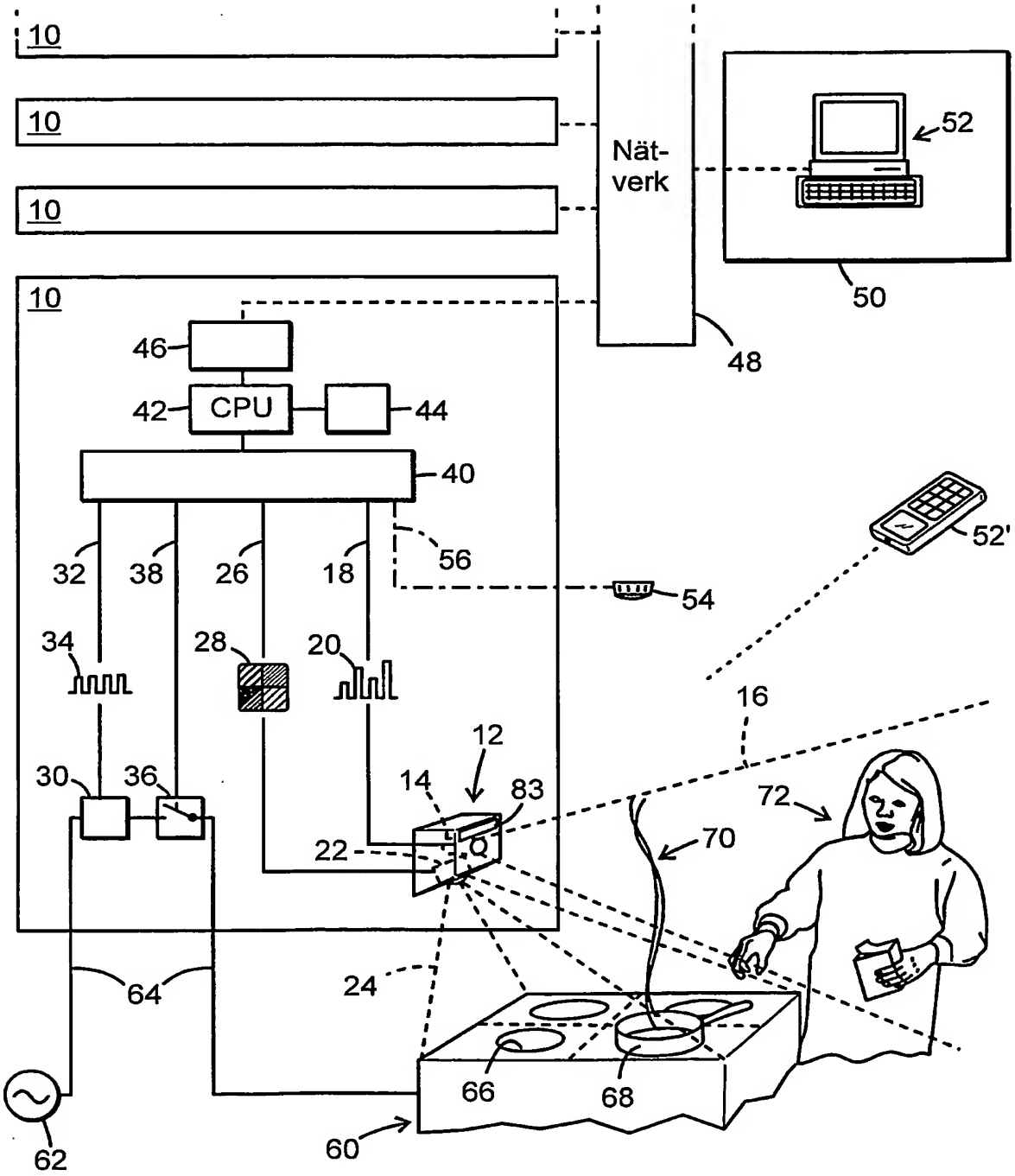
11. The method according to claims 9 or 10, c h a r a c t e r i s e d by the overheating state additionally including:

rising temperature after a longer period of constant temperature and constant temperature without the presence of a person.

# AMENDED CLAIMS

PCT/IB03/00810

**AMENDED CLAIMS**
[received by the International Bureau on 30 June 2003 (30.06.03);
original claims 1-13 replaced by amended claims 1-11 (2 pages)]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60
62

Fig. 1

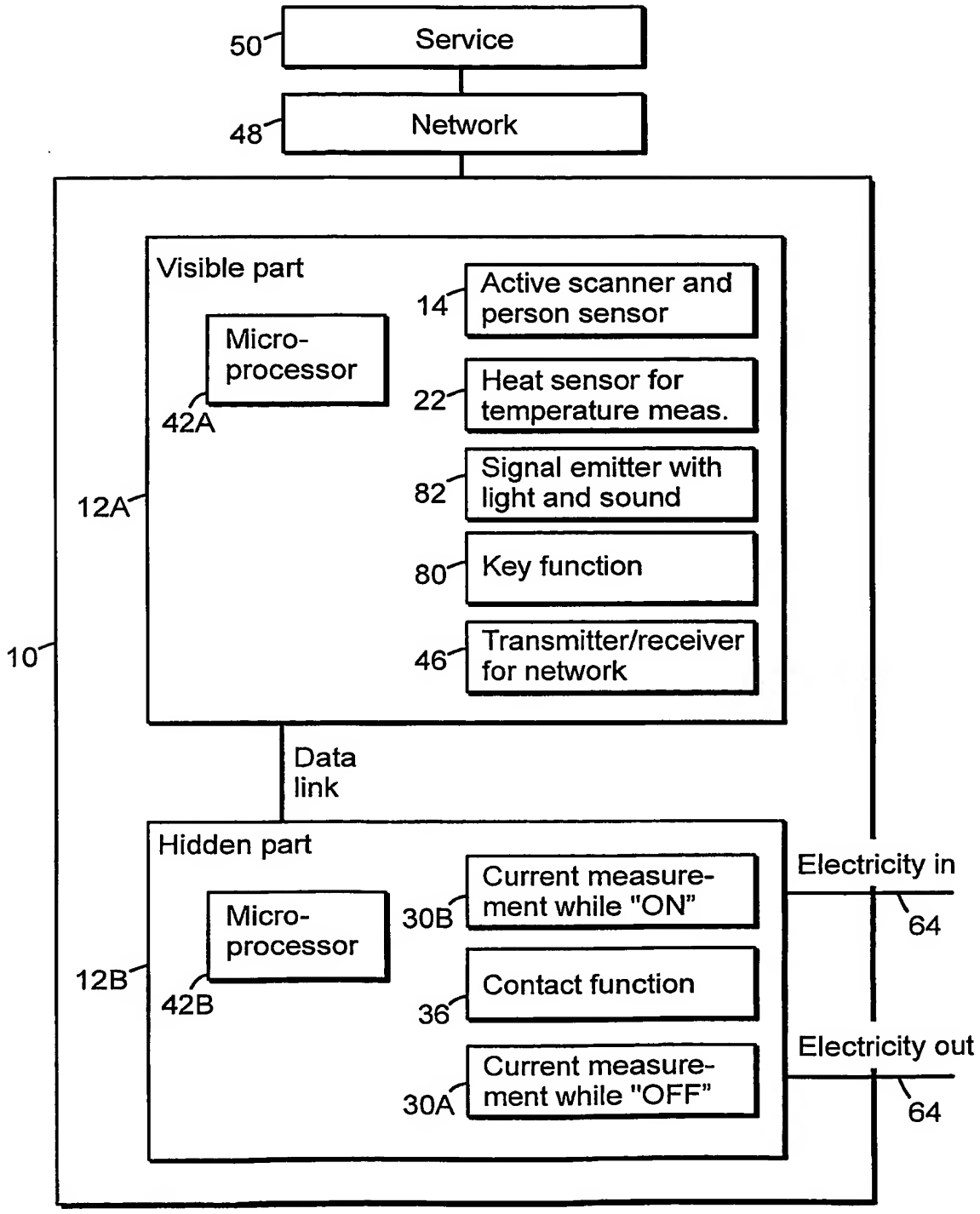
50
Service
48
Network
10
Visible part
14
Active scanner and person sensor
Micro-processor
42A
22
Heat sensor for temperature meas.
12A
82
Signal emitter with light and sound
80
Key function
46
Transmitter/receiver for network
Data link
Hidden part
Electricity in
64
Micro-processor
12B
42B
30B
Current measure-ment while "ON"
Contact function
36
Electricity out
30A
Current measure-ment while "OFF"
64

Fig. 2

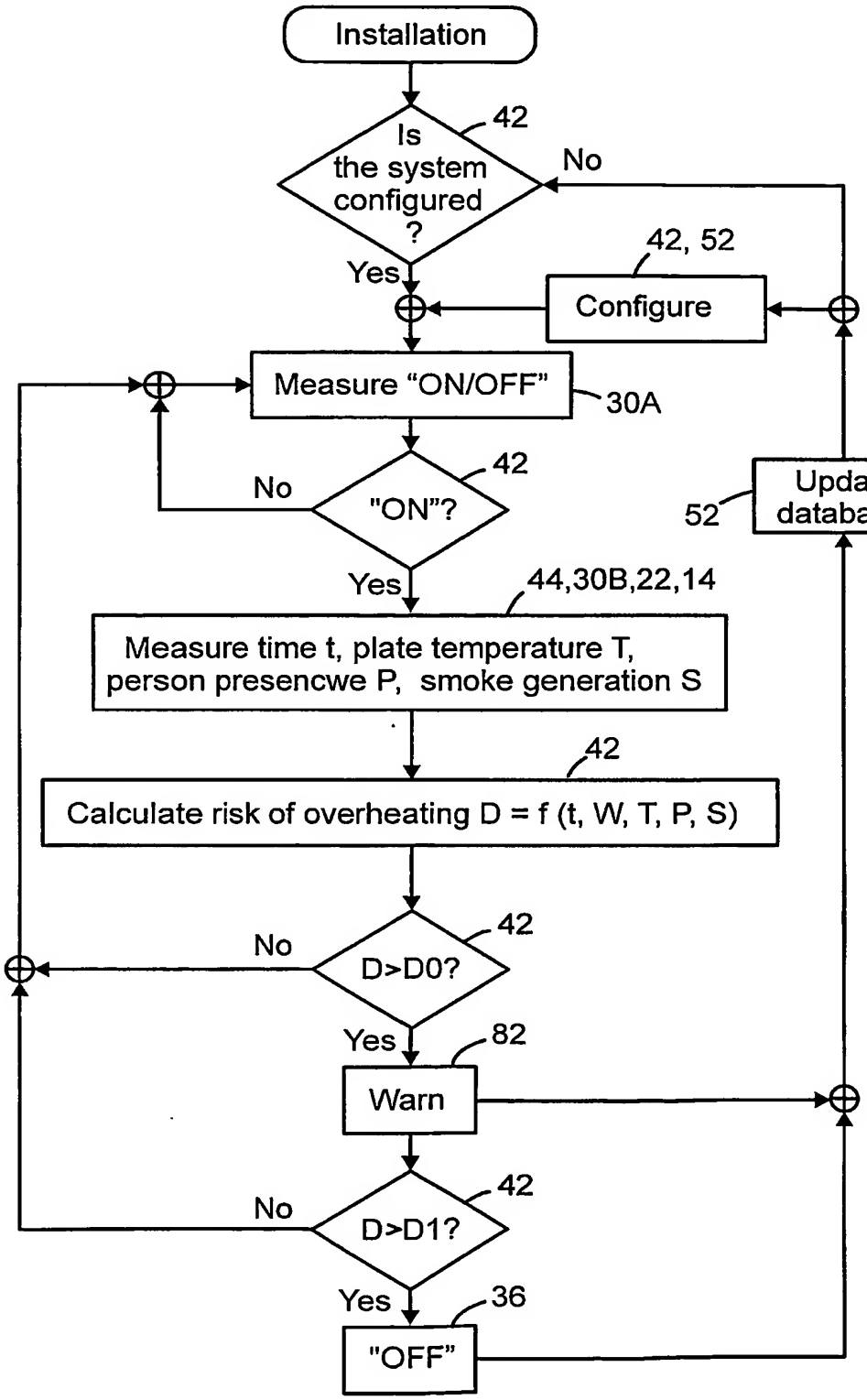
Installation
Is the system configured ?
42
No
Yes
42, 52
Configure
Measure "ON/OFF"
30A
No
"ON"?
42
Yes
Update database
52
44,30B,22,14
Measure time t, plate temperature T, person presencwe P, smoke generation S
42
Calculate risk of overheating D = f (t, W, T, P, S)
No
D>D0?
42
Yes
82
Warn
No
D>D1?
42
Yes
36
"OFF"

Fig. 3

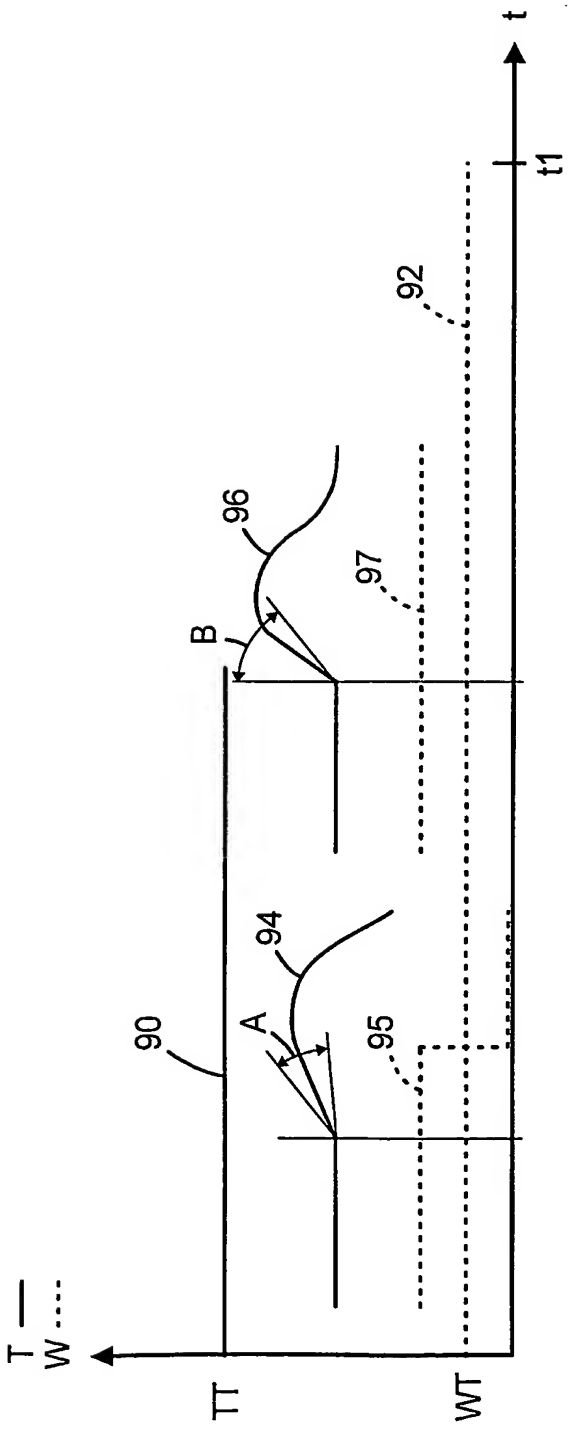


Fig.4

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 03/00810

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F24C 7/08, H05B 1/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: F24C, H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | DE 19629155 A1 (GGT GESELLSCHFT FÜR GERONTOTECHNIK MBH), 29 January 1998 (29.01.98), figures 1,2 | 1-13 |
| X | GB 2318650 A (ALAN BROWN), 29 April 1998 (29.04.98), page 4, line 29 - line 34; page 5, line 25 - line 31, figure 1 | 1-13 |
| A | US 5717188 A (VAILLANCOURT), 10 February 1998 (10.02.98), column 1, line 62 - column 2, line 41, figures 1,4 | 1-13 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 29 July 2003 | 30 -07- 2003 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>TOMAS LUND/BS<br>Telephone No. +46 8 782 25 00 |

Form PCT/ISA/210 (second sheet) (July 1998)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/IB 03/00810

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE 19629155 A1 | 29/01/98 | NONE | |
| GB 2318650 A | 29/04/98 | GB 9622086 D<br>WO 9817952 A | 00/00/00<br>30/04/98 |
| US 5717188 A | 10/02/98 | CA 2152015 A,C | 17/12/96 |